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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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Development of USES Aptitude Test Battery

for

Set-Up Man, Sheet Metal

(any ind.) 616.380

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U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION

Technical Report on Development of USES Aptitude Test Battery

For . . . . .

Set-Up Man, Sheet Metal (any ind.) 616.380

S-406

(Developed in Cooperation with the
Wisconsin State Employment Service)

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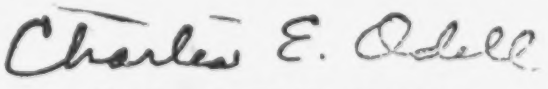
February 1968

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.



Charles E. Odell, Director
U. S. Employment Service

GATB Study #2678

Development of USES Aptitude Test Battery

For

Set-Up Man, Sheet Metal
(any ind.) 616.380-030

S-406

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Set-Up Man, Sheet Metal (any ind.) 616.380-030. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
P - Form Perception	80
Q-- Clerical Perception	90
M - Manual Dexterity	90

RESEARCH SUMMARY

Sample:

52 male workers employed as Sheet Metal Set-Up Men in Wisconsin.

Criterion:

Supervisory ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .54 (P/2 less than .0005)

Effectiveness of Norms:

Only 71% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-406 norms 89% would have been good workers. 29% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-406 norms only 11% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	71%	89%
Poor Workers	29%	11%

SAMPLE DESCRIPTION

Size:

N = 52

Occupational Status:

Employed workers

Work Setting:

Workers were employed at the following firms:

Aluminum Specialty Company - Chilton & Manitowoc, Wisconsin

Leyse Aluminum Company - Kewaunee, Wisconsin

Krueger Metal Company - Green Bay, Wisconsin

Mirro Aluminum Company - Manitowoc & Two Rivers, Wisconsin

Employer Selection Requirements:

Education: Eighth grade education preferred

Previous Experience: Promoted from lesser skilled jobs within plant; preferably press operator

Tests: None

Principal Activities: The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience: All workers in the sample had at least 7 months total job experience.

TABLE 2

Means, Standard Deviations, Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience.

	Mean	SD	Range	r
Age (years)	43.5	9.2	25-60	-.004
Education (years)	10.1	1.9	6-13	.309*
Experience (months)	112.8	71.8	7-282	.113

*Significant at the .05 level

Experimental Test Battery

All 12 tests of the GATB were administered during the period April-July, 1967.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as test data were collected. The immediate supervisor rated each worker.

Rating Scale:

Form SP-21 "Descriptive Rating Scale" was used. This scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternatives corresponding to different degrees of job proficiency.

Reliability:

A reliability coefficient of .89 was obtained between the initial ratings and re-ratings, indicating a significant relationship. The final criterion score consisted of the combined scores of the two ratings.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	54-89
Mean:	71.6
Standard Deviation:	8.7

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 29% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers". The criterion critical score is 67.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis the aptitudes listed appear to be important to the work performed)

Aptitude	Rationale
G - General Learning Ability	Required in learning correct procedure in setting up dies and in using judgment as to when adjustments are necessary; also, in understanding oral and written instructions.
S - Spatial Aptitude	Required in visualizing final product from oral and written instructions.
P - Form Perception	Required in making visual inspection of product in comparison to standard model and in reading gages and other measuring devices.
M - Manual Dexterity	Required in handling tools, wrenches, and dies and in manipulating operating controls of the machines.

TABLE 4

Means, Standard Deviations, Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 52.

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	96.7	17.2	63-131	.358**
V - Verbal Aptitude	92.3	12.4	66-117	.193
N - Numerical Aptitude	99.0	20.3	53-141	.427**
S - Spatial Aptitude	103.2	19.8	68-153	.332*
P - Form Perception	97.5	19.6	57-146	.278*
Q - Clerical Perception	106.1	15.0	71-146	.366**
K - Motor Coordination	92.1	15.4	43-126	.271
F - Finger Dexterity	85.1	19.0	53-133	.300*
M - Manual Dexterity	102.2	21.3	55-155	.464**

* Significant at the .05 level

** Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X			X	X				X
Irrelevant									
Relatively High Mean				X		X			X
Relatively Low Standard Dev.		X				X			
Significant Correlation with Criterion	X		X	X	X	X		X	X
Aptitudes to be Considered for Trial Norms	G		N	S	P	Q		F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of Aptitudes G, N, S, P, Q, F and M at trial cutting scores were able to differentiate between 71% of the sample considered to be good workers and 29% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. The optimum differentiation for the occupation of Set-Up Man, Sheet Metal 616.380-030 was provided by the norms of P-80, Q-90 and M-90. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .54 (statistically significant at the .005 level.)

TABLE 6

Concurrent Validity of Trial Norms
P-80, Q-90, M-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	32	37
Poor Workers	11	4	15
Total	16	36	52

Phi Coefficient = .54
Significance Level = P/2 less than .0005
Chi Square (χ^2_y) = 15.2

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score _____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read the sheet "Suggestions to Raters" and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of worker (print) _____
(Last) (First)

Sex: Male _____ Female _____

Company Job Title: _____

How often do you see this worker in a work situation?

- ☐ See him at work all the time.
- ☐ See him at work several times a day.
- ☐ See him at work several times a week.
- ☐ Seldom see him in work situation.

How long have you worked with him?

- ☐ Under one month.
- ☐ One to two months.
- ☐ Three to five months.
- ☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

- ☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.
- ☐ 2. Capable of low output. Can perform at a slow pace.
- ☐ 3. Capable of fair work output. Can perform at a acceptable but not a fast pace.
- ☐ 4. Capable of high work output. Can perform at a fast pace.
- ☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

- ☐ 1. Very poor. Does work of unsatisfactory grade. Performance is inferior and almost never meets minimum quality standards.
- ☐ 2. Not too bad, but the grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.
- ☐ 3. Fair. The grade of his work is mediocre. Performance is acceptable but usually not superior in quality.
- ☐ 4. Good, but the grade of his work is not outstanding. Performance is usually superior in quality.
- ☐ 5. Very good. Does work of outstanding grade. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

- ☐ 1. Very inaccurate. Makes very many mistakes. Work needs constant checking.
- ☐ 2. Inaccurate. Makes frequent mistakes. Work needs more checking than is desirable.
- ☐ 3. Fairly accurate. Makes mistakes occasionally. Work needs only normal checking.
- ☐ 4. Accurate. Makes few mistakes. Work seldom needs checking.
- ☐ 5. Highly accurate. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

- ☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.
- ☐ 2. Has little knowledge. Knows enough to "get by."
- ☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.
- ☐ 4. Has broad knowledge. Knows enough to do good work.
- ☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

- ☐ 1. Very low aptitude. Has great difficulty doing his job. Not at all suited to this kind of work.
- ☐ 2. Low aptitude. Usually has some difficulty doing his job. Not too well suited to this kind of work.
- ☐ 3. Moderate aptitude. Does his job without too much difficulty. Fairly well suited to this kind of work.
- ☐ 4. High aptitude. Usually does his job without difficulty. Well suited to this kind of work.
- ☐ 5. Very high aptitude. Does his job with great ease. Unusually well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

- ☐ 1. A very limited variety. Cannot perform different operations adequately.
- ☐ 2. A small variety. Can perform few different operations efficiently.
- ☐ 3. A moderate variety. Can perform some different operations with reasonable efficiency.
- ☐ 4. A large variety. Can perform several different operations efficiently.
- ☐ 5. An unusually large variety. Can do very many different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Very unresourceful. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Unresourceful. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Fairly resourceful. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Resourceful. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Very resourceful. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How often does he make practical suggestions for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Never. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Very seldom. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Once in a while. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Frequently. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Very often. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how satisfactory is his work? (Worker's "all-round" ability to do his job.)

☐ 1. Definitely unsatisfactory. Would be better off without him. Performance usually not acceptable.

☐ 2. Not completely satisfactory. Of limited value to the organization. Performance somewhat inferior.

☐ 3. Satisfactory. A fairly proficient worker. Performance generally acceptable.

☐ 4. Good. A valuable worker. Performance usually superior.

☐ 5. Outstanding. An unusually competent worker. Performance almost always top notch.

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FACT SHEET

Job Title:

Set-Up Man, Sheet Metal 616.280-030

Job Summary

Sets up, adjusts and maintains in good operating condition one or more machines to cut, draw, form, punch, trim and finish aluminum and sheet metal products such as cooking utensils, light fixtures, toys and automobile trim parts. Assists department foreman in supervising and instructing machine operators.

Work Performed

1. Sets up and adjusts punch, draw and forming presses. Removes dies from machine by unscrewing bolts with a hand wrench and lifting dies out of press by hand or with a hoist. Working from oral or written instructions, inserts new dies in place. Bolts upper and lower dies in position in machine. Adjusts various feed guides, carriages and discharge mechanisms, using its position in relation to the lower die; makes any necessary adjustments in position by loosening bolts and moving lower die. Adjusts length of stroke of ram by turning bolts. Checks operation of machine by producing a few trial stampings. Checks stamping for size with special gages and by comparison with standard models. Makes any necessary adjustments to correct defects in stampings and turns machine over to operator. Performs described duties in setting up and adjusting machines using single, combination, cutting and progressive dies, ranging in weight from a few pounds to 4,000 pounds.

2. Sets up and adjusts buffing and polishing lathes. Removes old wheels from arbor by the use of wrenches. Replaces and bolts new wheels in place. Checks and adjusts tension of belts. On automatic or semi-automatic machines, assembles holding chucks, removes and replaces worn polishing felts. Adjusts turn table on automatic machines so that operations are performed in proper sequence. Dismantles and reassembles feed chambers for buffing and polishing compounds. Operates machine and observes quality of work and makes any necessary adjustments. Turns machine over to operator.

3. Sets up and adjusts hand and automatic threading lathes. Uses wrenches to remove worn thread rolls. Opens gear housing and unbolts gears. Installs new thread rolls on spindles and bolts new gears in place. Adjusts meshing of gears and contact of thread rolls. Sets up and adjusts hand or automatic feed mechanism for proper operation. Operates machine to produce trial pieces and checks these with special gages and against samples. Makes any necessary adjustments to machine and turns machine over to operator.

4. Sets up spinning lathes. Dismantles forming chuck, tailstock and cutting and trimming devices using hand wrenches. Installs new chuck, tailstock, follow block and reposition trimming tool to produce desired product, using wrenches and other hand tools. Operates machine to produce trial pieces, makes any necessary adjustments and turns machine over to operator.

5. Sets up and adjusts trimming and beading machines. Dismantles machine with the use of wrenches and other hand tools. Assembles and installs holding checks, beading roal and various cutters to trim excess metal from various cupped metal shapes and form a beaded edge. Adjusts feed slide, positions checks, cutters and beading roll and bolts them securely in place. Installs air line in correct position for discharging completed product from machine. Operates machine to produce trial pieces, makes necessary adjustments and turns machine over to operator.

6. Sets up and adjusts various other machines at infrequent periods, such as eyelet machines, clinching machines and metal shears. Installs tools, holding fixtures, feed mechanisms and other parts.

7. Periodically checks quality of production of machine in his department and keeps them in proper operating condition. Notifies foreman of defective dies.

8. Under direction of foreman, instructs new employees in the operation of machines and verifies their production reports.

Effectiveness of Norms

Only 71% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-406 norms, 89% would have been good workers. 29% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-406 norms only 11% would have been poor workers.

Applicability of S-406 Norms

The aptitude test battery is applicable to jobs which require the set up of one or more of the machines described in section 1-5 above.

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